



Procedures and Guidelines (PG)

DIRECTIVE NO. 803-PG-8730.1.9A
EFFECTIVE DATE: June 28, 2016
EXPIRATION DATE: June 28, 2021

APPROVED BY Signature: Original Signed by
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TITLE: Chief, Safety Office

COMPLIANCE IS MANDATORY

Responsible Office: 803/Safety Office

Title: Wallops Flight Facility Metrology and Calibration Laboratory Quality Manual

PREFACE

P.1 PURPOSE

This Quality Manual describes the Quality System (QS) applicable to Wallops Flight Facility (WFF) Metrology and Calibration Laboratory (MCL) and enables the standards of ANSI/NCSL Z540.1 1994 (R2002), ISO 9001:2008, and AS9100C:2009 to be met at the Metrology and Calibration Laboratory (MCL). These standards are traceable to national, international, or intrinsic standards of measurements

P.2 APPLICABILITY

WFF's MCL provides complete metrology and calibration services through selected contractors and subcontractors. The extent of service varies from customer to customer. WFF's MCL is conveniently located at the Building F-160, supporting various customers at WFF.

Customers and their respective service requirements may be categorized as:

- NASA/WFF civil service organizations – Requirements include control of Measuring and Test Equipment (MTE) including calibration, recall and subjected to government audit for compliance.
- Contractor organizations having their own quality management system – Require supporting calibration on demand. These organizations have their own recall and audit system for compliance requiring MTE's to be calibrated and repaired (if required).
- Tenant organizations – Requirements include calibration and repair (when needed) with their own recall and audit compliance.

P.3 AUTHORITY

- a. NPD 8730.1, Metrology and Calibration
- b. GPR 8730.1, Calibration and Metrology
- c. GPR 1280.1, Quality Manual

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P.4 APPLICABLE DOCUMENTS AND FORMS

- a. ANSI/NCSL Z540.1-1994 (2002), American National Standard Institute, Calibration Laboratories and Measuring and Test Equipment, General Requirements
- b. ISO 9001-2008, American National Standard Quality Management Systems Requirements
- c. AS 9100C:2009, Quality Management System for Aerospace
- d. GPR 1400.1, Waiver Processing
- e. GPR 1410.1 Directives Management
- f. GPR 1410.2 Configuration Management
- g. GPR 5340.2, Control of Process Non-conformances and Customer Complaints
- h. GPR 9980.1, Internal Audit System
- i. Met/Cal and Met/Track Software – Fluke Corporation
- j. 803-WI-8730.1.8, WFF Metrology and Calibration Laboratory Procedure Manual
- k. GSFC 18-1, Task Order Request for Service Quality Verification Laboratories GSFC/WFF
- l. WI-710, Task Order Request for Service Quality Verification Laboratories

Note: If any process in this document conflicts with any document in the American National Standards Institute (ANSI)/National Conference of Standards and Laboratories (NCSL) Z540.1-1994 (R2002), this document shall be superseded by the ANSI/NCSL Z540.1-1994 (R2002) document. Any reference document external to ANSI/NCSL Z540.1-1994 (R2002) shall be monitored by the Process Owner for current versioning.

P.5 CANCELLATION

803-PG-8730.1.9, Wallops Flight Facility Metrology and Calibration Laboratory Quality Manual

P.6 SAFETY

N/A

P.7 TRAINING

Based on the requirements provided to the Laboratory Manager (LM) through the Statement of Work (SOW), the MCL staff personnel shall have the necessary education, training, technical knowledge and experience for their assigned functions. Training records, dates, attendees, and training topics are kept by the LM. If any additional training is required to meet new requirements for a particular task, or if there is a difference between the employees' qualifications and the task requirements, training or other actions will be taken to provide the employee with the necessary competence to perform the job or task. More information on employee training and qualifications is located in 803-WI-8730.1.8.

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P.8 RECORDS

| Record Title | Record Custodian | Retention |
|--|------------------|--|
| Met/Track Records, including Recall List | Lead Technician | *NRRS 8/41.5A.1, Destroy 5 to 10 years after the equipment is excessed or no longer in NASA Inventory. |
| Shipping Documents | Lead Technician | *NRRS 8/41.5A.1 |
| Environment/Deterioration Log Sheets | Lead Technician | *NRRS 8/41.5A.1 |
| GSFC 4-43 Out of Tolerance Report | Lab Manager | *NRRS 8/41.5A.1 |
| Customer Satisfaction Survey Forms | Lab Manager | *NRRS 1/26.5B, Destroy when 5 years old |

* NRRS 1441.1 – NASA Records Retention Schedule

P.9 MEASUREMENT/VERIFICATION

PROCEDURES

In this directive, all mandatory actions (i.e., requirements) are denoted by statements containing the term “shall”. The terms “may” or “can” denote discretionary privilege or permission; “should” denotes a good practice and is recommended but not required; “will” denotes expected outcome and “are/is” denotes descriptive material.

The WFF calibration contractor’s management is responsible for the reporting of metrics to the NASA Technical Monitor (NTM). At a minimum, metrics include the following:

- Number of Measurement and Test Equipment (MTE) items processed
- Out of Tolerance Reports (OOT)
- Customer satisfaction (as measured by user feedback)

1.0 QUALITY POLICY

The MCL’s Quality Policy is same as the *GSFC Quality Policy*, GPR 1280.1.

To effectively support this quality policy, all calibrations conducted in the MCL shall be performed in accordance with ANSI Z540.1-1994:R2002, ISO 9001:2008, or AS9100C:2009. All procedures are controlled documents and carry the designated approval signatures and issue date.

Every employee involved in work applicable to the Quality System (QS) is responsible for ensuring the Quality Policy is understood, implemented, and maintained.

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2.0 ORGANIZATION AND MANAGEMENT

The MCL's organizational structure in descending hierarchy order:

- a. NASA Positions (Civil Servants): Code 803 Safety Office Management and NASA Task Monitor (NTM)
- b. Contractor Positions: Contractor Service Area Manager (C-SAM), Laboratory Manager (LM), Quality Manager (QM), Technical Manager (TM) and multiple positions for Metrology Technician (MT).

Positions within the organization can be defined as follows:

NASA Task Monitor (NTM) – The NTM is responsible for providing the Statement of Work (SOW) for the work performed at the MCL. The NTM reviews the performance against agreed budget, quality, productivity, and provide regular feedback and evaluation. The NTM is responsible for ensuring the MCL follows all the NASA directives and maintains the appropriate records and reports. NTM is the point of contact for scheduling audits.

Contractor Service Area Manager (C-SAM) – The C-SAM is responsible for ensuring that the MCL is staffed by qualified individuals. The C-SAM will monitor the MCL performance and risks, and report them to the NTM. Formal communication between the laboratory staff and the NTM will flow through the C-SAM.

The Laboratory Manager (LM) – The LM is responsible for the general MCL operation, calibration methods, procedures, and objective of the calibration and assessment of the results.

This includes:

- a. Identification of the resources (equipment, manpower, and training) required to operate the MCL.
- b. Planning and monitoring the calibration activities.
- c. Ensuring that all personnel working in the MCL are trained to meet the requirements of this manual.
- d. Consulting with NTM and C-SAM concerning training, staffing, priority and budget issues.
- e. Reviewing customer surveys and resolving complaints.

Technical Manager (TM) – The TM is responsible for all technical aspects of the laboratory including but not limited to standard selection, calibration method selection, and technical qualifications of personnel. The TM acts as an alternate for the LM during the absence of LM.

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Quality Manager (QM) – The QM is responsible for the QS and its implementation. QM acts as an alternate for the LM during the absence of LM and TM. The Quality Manual will be maintained by and the responsibility of the QM.

Metrology Technician (MT) – The MT is responsible for calibration and testing of assigned MTE.

803-WI-8730.1.8 contains more details on training and employee qualifications.

2.1 Procedures and Document Control

Documents that form the MCL Quality System (PG, WI and GSFC Forms) will be controlled and available via the Goddard Directives Management System (GDMS) with compliance to GPR 1410.1. Quality System documents are periodically reviewed to ensure their continuing suitability and compliance with applicable requirements. Revisions are made as necessary in accordance with GPR 1410.1 and GPR 1410.2. Any obsolete documents are promptly removed and archived from all points of issue or use, or otherwise assured against unintended use.

3.0 COMMUNICATION SYSTEM

Internal communication takes place regularly each week, month and year. Methods for communicating include, but are not limited to, the following:

- a. Emails communicating happenings in the MCL,
- b. Transmitting documents,
- c. Meeting notes and other miscellaneous information.
- d. Weekly, monthly and yearly meetings will discuss the status of the MCL, procedural changes and QS information.

The SOW is the document NASA utilizes to record and communicate information to the contractor regarding support and services required for the customers. The SOW defines the customers and the type and quantity of MTE's required to be calibrated over a period of time.

Customer meetings enable interactions between the MCL staff and the customers for informational purposes; such as calibration details, limitations on use of the equipment (if applicable), repair information (if applicable) and other clarifications needed.

Resources regarding the funding, number and skill types of personnel required to perform the calibration laboratory support and services will be determined by the C-SAM and LM, with the help of the information provided in the SOW. Government requests for services, contractor response and transfer of funds from the Government to the contractors will be performed electronically through NASA's Information and Technology (IT) system. All communications will be strictly administered, maintained

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and controlled through the Government for retention. Task Order planning is performed to ensure no undue pressure is levied upon the MCL personnel. The NASA IT system also provides the ability to protect confidentiality and proprietary rights of customers. Only users of the NASA Informational and Technology system are able to logon. The policies and procedures in 803-WI-8730.1.8 will be followed to ensure customer confidentiality and the protection of proprietary rights.

4.0 NEW WORK

The MCL accepts new work and provides support to customers as directed by the contract SOW. All new work is reviewed by the NTM, C-SAM and LM to ensure the MCL has appropriate facilities and resources to provide support to customers.

4.1 Approved Vendor Services

If the MCL is unable to provide the required support, the MCL arranges services with an approved vendor. Approved vendors are required to meet the same level of accreditation and certification as the MCL, per NASA requirements. The approved vendor procedure is found in 803-WI-8730.1.8.

4.2 Exception to Procedure

The MCL is permitted to depart from the documented procedures or standardized specifications. New standards or procedures that are used are first reviewed and discussed between the customer, QM and LM, and, if accepted, are recorded and added to the standards exceptions for future reference. The process for establishing exceptions to procedures can be found in 803-WI-8730.1.8.

5.0 CALIBRATIONS AND VERIFICATIONS

The MCL's full calibration process is performed per 803-WI-8730.1.8. The QM and/or the LM updates calibration procedures. Further instructions for inspection, receiving, care and transportation of MTE are found in 803-WI-8730.1.8.

5.1 Calibration Procedures

The government furnished software, Met/Cal, provides documented instruction on the use and operation of equipment, including handling and preparation of items for calibration and verifications. Some tailoring may be required to meet the specific needs of the MCL. All instructions, standards, manuals and reference data relevant to the MCL will be maintained as records and should be readily available to the MCL staff in the MCL Library. All policies and procedures will be performed per GPR 8730.1.

The MCL uses appropriate methods and procedures for calibrations and related activities within its responsibility (including, but not limited to, handling, transport and storage, preparation of items, estimation of uncertainty of measurement and analysis of calibration data). Calibration procedures will be obtained from the manufacturers' manuals, from the Government Industrial Data Exchange Program (GIDEP) or are developed in house. Calibration procedures obtained from outside sources are reviewed by the TM, LM or C-SAM prior to being used in the MCL for validation. Calibration procedures

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developed in-house will be validated prior to use and require approval by the TM, LM or C-SAM. 803-WI-8730.1.8 outlines the process for Deviation from Procedures.

The MCL ensures that calibration uncertainties are sufficiently small, so that the adequacy of the measurement is not affected. When required by the customer, well defined and documented measurement assurance techniques will be used to verify the adequacy of the measurement process. If such techniques are not used for a particular measurement, then the collective uncertainty of the measurement standards, where possible will not exceed 25% of the acceptable tolerance (manufacturer's specification) for each characteristic of the measuring and test equipment being calibrated or verified.

If the MTE received from the user for servicing is found to be out of acceptable tolerance, the MT notifies the user and records the information in GSFC Form 4-43 - Out of Tolerance Report (OOT) per GPR 8730.1. Detailed instructions can be found in the "PROCEDURES" section of GPR 8730.1.

6.0 MEASUREMENT TRACEABILITY

MCL procedures for achieving traceability of measurements will be documented with NASA provided software, Met/Track and Met/Cal. Computers are used to capture, process, manipulate, record, report, store and retrieve calibration data. The NASA established IT security system monitors computer activity, protects and maintains the stored data. Procedures for the control of the database can be found in 803-WI-8730.1.8. Met/Track is used to generate and record calibration reports traceable to national, international or intrinsic standards of measurements.

7.0 EQUIPMENT

The MCL furnishes all equipment (including reference materials) required for the correct performance of calibration/verification. Procedures for Management of MCL equipment can be found in 803-WI-8730.1.8. The MCL supplies the required tags and labels for MTE, per GPR 8730.1.

All equipment, software and reference materials necessary to perform calibrations in the MCL are calibrated, maintained and recorded by the LM. The MCL is required to maintain a registry for monitoring and measuring equipment with the NASA IT system. Met/Track will be used to generate and record calibration reports that are traceable to national, international or intrinsic standards of measurements. This process is consistent with monitoring and measuring requirements and includes the following information:

- a. Equipment type with unique identification
- b. Location
- c. Frequency of checks and check method
- d. Acceptance criteria
- e. Specified calibration intervals, or prior to use, against measurement standards traceable to international and national measurement standards

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- f. Calibration data sheets
- g. Personnel that performed the calibration tests
- h. Environmental conditions

In cases where the laboratory needs to use equipment outside its permanent control, the equipment may be borrowed, rented or leased. In such cases the equipment is accompanied by objective evidence that it conforms to the requirements of ANSI/NCSL Z540.1.

Examples of objective evidence may be:

- a. Records of audits performed by a GSFC accredited organization
- b. Proof that the rental company's calibration laboratory is accredited per ANSI/NCSL Z540.1
- c. Acceptance of the rental company's calibrations by a government agency showing compliance to ANSI/NCSL Z540.1
- d. A list of key suppliers for the calibration laboratory equipment and materials

Any equipment which has been subjected to overloading or mishandling, or gives suspicious results, or has been shown by verification or otherwise to be defective, will be taken out of service, tagged with a 4-43 tag and have its calibration sticker removed. Whenever possible, MTE will be stored at a specified place until it has been repaired and shown by calibration or verification to perform satisfactorily. The MCL examines the effects of this defect on previous calibration and provides a customer notification for all calibrations that may be affected.

The LM performs the MTE recall per 803-WI-8730.1.8 and also per GPR 8730.1.

7.1 Equipment Standards

Measurements performed at the MCL for calibration of MTE are traceable to national, international or intrinsic standards of measurements. The MCL utilizes government furnished software (MET/CAL and MET/Track), which is capable of providing the measurement results and the associated uncertainty measurement or a statement of compliance with an identified metrological specification upon request by the MTE customer/owner.

Reference and transfer standards will be stored in a safe environment and maintained per manufacturer's recommendation. Reference standards are to be calibrated by a competent body that can provide traceability to national, international or intrinsic standards of measurements. Met/Track is the Fluke developed software being used at WFF MCL to capture relevant information associated with MTE including the recall process.

All standards shall have a copy of the calibration certificate on file linked to the Met/Track, requiring laboratory personnel to reference before using the instrument as a standard.

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7.2 Environmental Conditions for Equipment

The Government has furnished laboratory accommodations, calibration areas, energy sources, lighting, temperature, humidity and ventilation to facilitate proper performance of calibrations/verifications. Facilities Management Division at WFF coordinates with the LM to ensure the MCL environmental requirements are met; if problems associated with the facility occur, they are reported immediately through the helpline. The laboratory environment is monitored and recorded with hygrothermographs in each MCL room, including storage rooms for equipment, tools and parts.

Employees will not remove calibration equipment from the MCL without first conferring with a MCL LM, QM, TM or MT. All calibration equipment will be controlled and any moves or changes will be documented in Met/Track database. More details on the environmental conditions can be found in 803-WI-8730.1.8.

8.0 QUALITY ASSURANCE

Quality assurance will be provided with transfer and reference standards equipment for inter-laboratory comparison. When requested by the customer, a certificate of calibration will be issued by the MCL that contains accurate, clear, unambiguous and objective calibration measurements. In addition, the certificate format and contents must be in compliance ANSI Z540.1.

8.1 Corrective Action

GSFC's Quality Manual (GPR 1280.1) and the Deviation and Waivers directive (GPR 1400.1) will be followed for feedback and corrective actions whenever discrepancies are detected or departures from documented policies and procedures occur. Corrective Actions will be vetted through the NTM and the Quality Manager and resolved as soon as possible per GPR-5340.2 - *Documentation and Control of Process Nonconformances and Customer Complaints*.

8.2 Certificate of Calibration from Outside Vendors

The technical review process for certification from outside vendors shall be completed utilizing the QA stamp (signature, printed name and date). In addition, the certificate format and contents must be in compliance ANSI Z540.1.

9.0 CUSTOMER FEEDBACK

Customer feedback policies are described in 803-WI-8730.1.8.

9.1 Customer Satisfaction

Customer Satisfaction will be monitored by the issuance of Customer Satisfaction Survey Forms, which are sent to all WFF MCL Customers no less than once per year. All Customer Satisfaction Survey Forms to be reviewed by the LM, C-SAM, and NTM, and kept on file in the MCL.

9.2 Customer Feedback/Complaints:

Refer to 803-WI-8730.1.8.

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10.0 AUDITS/REVIEWS

Audits will be performed per GPR 9980.1. The audit criteria, scope, frequency, methods, responsibilities, requirements for planning, reporting, and maintaining results, are defined in GPR 9980.1, *Internal Audit Process*.

10.1 Quality Reviews

The C-SAM, LM, and QM review the QS to ensure it is adequate for achievement of the objectives on a continuous basis. The maximum interval between management reviews will be no more than 12 months. The review should include the following:

- a. Matters arising from the previous review
- b. Reports from audits by clients
- c. Results of internal audits done since the last review, including corrective actions implemented
- d. Results of in-house quality checks
- e. Details of any complaints or feedback from clients
- f. Staff training
- g. Adequacy of staff, equipment and facility resources
- h. Future plans and estimates for new work, new staff, new equipment, etc.
- i. Suitability of policies and procedures
- j. Reports from managerial and supervisory personnel
- k. The results of inter-laboratory comparisons or proficiency tests
- l. Changes in volume and type of work

The findings from the management reviews and the actions that arise from them are recorded and provided to the NTM. The C-SAM, LM and QM ensure those corrective actions are carried out within an appropriate and agreed timescale. All audit findings and any corrective actions that arise from them will be documented per GPR 5340.2. The NTM ensures these actions are discharged within the agreed upon timeframe.

10.1.1 Quality Checks

In addition to audits, the MCL is required to implement various other checks to ensure the quality of results. These checks are reviewed and appropriate actions taken as necessary. These checks shall, as appropriate, include:

- a. Internal quality control (statistical techniques wherever possible)
- b. Inter-laboratory comparisons
- c. Regular use of certified reference materials
- d. Replicate measurements
- e. Correlation of results for different characteristics of an item
- f. Over the shoulder checks will be performed by Metrology Calibration personnel serving as Quality Assurance to verify process compliance

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10.2 Calibration Intervals

MCL policy is to calibrate MTE's on a frequency recommended by the manufacturer, unless customers request an alternate interval that will not contradict the manufacturer's recommendation. The MCL will determine the End of Period Reliability (EOPR) for each calibrated item in which the calibration frequency has been extended. The process for establishing calibration intervals will be based on EOPR.

Extensions of MTE calibration intervals (for up to 30 days beyond the calibration expiration due date) shall only be granted for critical tests, critical operations or other requirements provided to the MCL. Extensions will only be granted prior to the MTE calibration due date and when no prior OOT's have been documented in the last (3) consecutive service cycles. For lifecycle testing beyond the 30 day extension timeline (without calibration) follow the requirements of GPR 1400.1, Waiver Processing.

11.0 DETERMINING UNCERTAINTY

The MCL ensures maintaining a Test Accuracy Ratio (TAR) of 4:1 for all test points. When a 4:1 TAR is not achievable with the working standards available in the MCL, the following methods are required to ensure the adequacy of calibration:

- If practical, reassign the item to the Standards Laboratory, calibrate it as a standard, and generate a Report of Test; which provides the test results and uncertainty.
- Determine the uncertainty of the calibration process and report this value on the Calibration Data Sheet (CDS) along with the tolerance for each test point which has a TAR of less than 4:1.
- Document the uncertainty for any points with a TAR of less than 4:1 in the Specification Reference.
- Obtain authorization from the customer and document for an accuracy limitation to the tolerance to provide a 4:1 TAR.
- Assign an uncertainty to the item and calibrate it to that uncertainty on a Calibration Data Sheet (CDS). Document the uncertainty analysis as part of the Specification Reference. Document the limitation as an Insufficient Standards Limited Calibration. When a specific measurement process or specific laboratory standards is required to achieve the minimum TAR for a calibration, the MT ensures these standards are identified on the CDS or in the relevant procedure.

Any non-standard method employed requires concurrence by the customer and the results are made available to the customer.

Further instruction for limited calibration can be found in 803-WI-8730.1.8.

Appendix A – Definitions

- A.1 **Approved Vendors** – A company that has been able to meet the same level of accreditation and certification as the MCL, per NASA requirements (ANSI Z540.1 and GPR 8730.1).
- A.2 **Calibration** – the set of operations which establish, under specified conditions, the relationship between values indicated by a measuring instrument or measuring system, and the corresponding standard or known values derived from the standard.
- A.3 **Calibration Certificate** – The result of a calibration may be recorded in a document called a calibration certificate, which presents the calibration results and other relevant information to the calibration.
- A.4 **Calibration Factor** – the result of a calibration can be expressed as a calibration factor, or a series of calibration factors in a calibration curve.
- A.5 **Calibration Label** – A label affixed to MTE to show its calibration status.
- A.6 **Calibration Method** – A defined technical procedure for performing a calibration or verification.
- A.7 **Certified Reference Material (CRM)** – A reference material one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a body.
- A.8 **Environmental Outage** – When the Calibration Laboratory's temperature and or humidity does not meet the specifications described in this document.
- A.9 **Hygrothermograph** – An instrument that measures temperature and humidity.
- A.10 **Interlaboratory Comparisons** – Organization, performance, and evaluation of calibrations on the same or similar items by two or more laboratories in accordance with predetermined conditions.
- A.11 **International (measurement) Standard** – A standard recognized by an international agreement to serve internationally as the basis for fixing the value of all other standards of the quantity concerned.
- A.12 **Influence Quantity** – A quantity which is not the subject of the measurement but which influences the value of the measurand or the indication of the measuring instrument.

- A.13 **Limits of Permissible** – The extreme values of an error permitted by specifications and regulations, for a given measurement instrument.
- A.14 **Measurand** – A quantity subjected to measurement.
- A.15 **Measurement** – The set of operations having the object of determining the value of a measurand.
- A.16 **Measurement Assurance** – a technique used to ensure the measurement process uses good experimental design, complete experimental characterization, and continuously monitoring of the performance and state of statistical control.
- A.17 **Measuring and Test Equipment (MTE)** – All of the measuring instruments, standards, reference materials, and auxiliary apparatus necessary to perform a measurement.
- A.18 **Measuring Instrument** – A device intended to make a measurement
- A.19 **Mutual Consent Standard** – An artifact or process that is used as de facto standard by mutual consent of the supplier and customer when no U.S. standard is available.
- A.20 **Metrology and Calibration Laboratory (MCL)** – Laboratory that calibrates and performs calibrations, verifications, and issues calibration certificates, limited calibration certification, etc.
- A.21 **Proficiency Testing** – Determination of the laboratory calibration performance by inter-laboratory comparisons or other means.
- A.22 **Quality Audit** – A systematic and independent examination to determine whether quality activities and related results comply with planned arrangement and whether these arrangements are implemented effectively and suitable to achieve objectives.
- A.23 **Quality Manual** – A document stating the quality policy, quality statement, and the quality practices of an organization
- A.24 **Quality Management System** – The organizational structure, responsibilities, procedures, processes, and resources for implementing quality management.
- A.25 **Quality System Review** – A formal evaluation by management of the status and adequacy of the QS in relation to quality policy and new objectives resulting from changing circumstances
- A.26 **Reference Material** – A material or substance of which one or more properties are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials.

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- A.27 **Reference Standard** – A standard, generally of the highest metrological quality available at a given location, from which measurements made at that location are derived.
- A.28 **Requirement** – A translation of the needs into a set of individual quantified or descriptive specification for the characteristics of an entity in order to enable its realization and examination.
- A.29 **Traceability** – The property of a result of a measurement whereby it can be related to appropriate standards, generally national or international standards, through an unbroken chain of comparisons.
- A.30 **Uncertainty or Measurement** – Parameter associated with the result of a measurement, which characterizes the dispersion of the values that could reasonably be attributed to the measurand.
- A.31 **Verification** – Evidence by measurement that specified requirements have been met.

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Appendix B – Acronyms

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| ANSI | American National Standard Institute |
| CDS | Calibration Data Sheet |
| CRM | Certified Reference Material |
| C-SAM | Contractor Service Area Manager |
| EOPR | End of Period Reliability |
| GDMS | Goddard Directives Management System |
| GIDEP | Government Industrial Data Exchange Program |
| GPR | Goddard Procedural Requirements |
| GSFC | Goddard Space Flight Center |
| IT | Information and Technology |
| LM | Laboratory Manager |
| MCL | Metrology and Calibration Laboratory |
| MET/CAL | Metrology Calibration Software by Fluke |
| MET/TRACK | Metrology Tracking Software by Fluke |
| MTE | Measuring Test Equipment |
| MT | Metrology Technician |
| NASA | National Aeronautics and Space Administration |
| NCR | Non-Compliance Report |
| NIST | National Institute for Standards and Technology |
| NTM | NASA Task Monitor |
| OOT | Out of Tolerance Report |
| QM | Quality Manager |
| QS | Quality System |
| RITS | Receiving Inspection and Test System |
| SOW | Statement of Work |
| TAR | Test Accuracy Ratio |
| TM | Technical Manager |
| TOMS | Task Order Management System |
| WFF | Wallops Flight Facility |

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Appendix C – Accountability Matrix

| SECTION | ANSI/NCSL Z540.1-1994(2002) Phrasing | Addressed in Quality Manual Section: |
|-----------------------------|---|--------------------------------------|
| 5.2a | a quality statement, including objectives and commitments, by top management; | 1.0 |
| 5.2b | the organization and management structure of the laboratory, its place in any parent organization and related organization charts; | 2.0 |
| 5.2c | the relations between management, technical operations, | 2.0 |
| 4.0-4.2 | support services and the quality system; | |
| 5.2d | procedures for control and maintenance of documentation; | Page 18 Change History Log |
| 5.2e 4.2 f, g, h, 6.0 | job descriptions of key staff and reference to descriptions of other staff; | 2.0 |
| 5.2f | identification of the laboratories approved signatories (where this concept is appropriate); | Not Applicable |
| 5.2g | the laboratories procedures for achieving traceability of measurements; | 6.0 |
| 9.0 | Measurement and Traceability Calibration | |
| 10.7 | Computer and Automated Equipment Requirements | |
| 5.2h | the laboratories scope of calibrations and/or verifications; | 5.0 |
| 5.2i | arrangements for ensuring that the laboratory review all new work to ensure that it has the appropriate facilities and resources before commencing such work; | 4.0 |
| 5.2j | reference to the calibration and verification procedures used; | 5.1 |
| 5.2k | procedures for handling calibration and verification items; | |
| 10.1, 11 | Calibration Methods | |
| 5.2l, 13 | reference to the major equipment and reference to measurement standards used; | 7.0 |
| 8.0-8.4 | Equipment and Reference Materials | |
| 5.2m | reference to procedures for calibration, verification and main of equipment used; | 7.1 |
| 9.2 | Traceable to National, International, or Intrinsic Standards. | |
| 5.2n, 12 | reference to quality assurance practices including inter-laboratory comparisons, proficiency testing programs, use of reference materials and internal quality control schemes; | 8.0 |
| 5.2o | procedures to be followed for feedback and corrective action whenever measurement discrepancies are detected, or departures from documented policies occur; | 8.1 |

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| 5.2p, 15 | the laboratory management arrangements for exceptionally permitting departures from documented policies and procedures or from standard specifications; | 4.1 |
| 5.2q, 16 | procedures from dealing with complaints; | 9.2 |
| 5.2r | procedures for protecting confidentiality and proprietary rights; | 3.0 |
| 5.2s | procedures for audit and review; | 10.0 |
| 5.2t | a statement of the laboratories policy for establishing and changing calibration intervals for equipment it controls; | 10.1 |
| 5.2u | a statement of the laboratories policy concerning the technique(s) to be used for determining measurement uncertainty and calibration/verification adequacy. | 11.0 |
| 5.3, 5.6 | Laboratory shall arrange for audits of its activities at appropriate intervals to verify that its operations comply with the requirements of the quality system... | 10.0 |
| 5.4 | The quality system adopted to satisfy the requirements of this Standard shall be reviewed at least once a year... | 10.1 |
| 5.5 | All audit and review findings and any corrective actions that arise from them shall be documented... | 8.1 |
| 7 | Accommodation and Environment | 7.2 |
| 14 | Sub-Contracting of Calibration | N/A |

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CHANGE HISTORY LOG

| Revision | Effective Date | Description of Changes |
|----------|----------------|---|
| Baseline | 11/10/2015 | Initial Release. This Work Instruction replaces 500-PG-8730.1.5 same title due to re-organization |
| A | June 28, 2016 | <ul style="list-style-type: none">• Administrative corrections• Incorporated new GSFC 18-1 Electronic Form• Moved specific certificate requirements from section 8 to 803-WI-8730.1.8• Added instructions on certificates from vendors• Added a Quality Check• Calibration Intervals changed from annual basis to manufacturer recommendations• Added an option to extend calibration intervals for critical tests and operations |
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